Fig.1

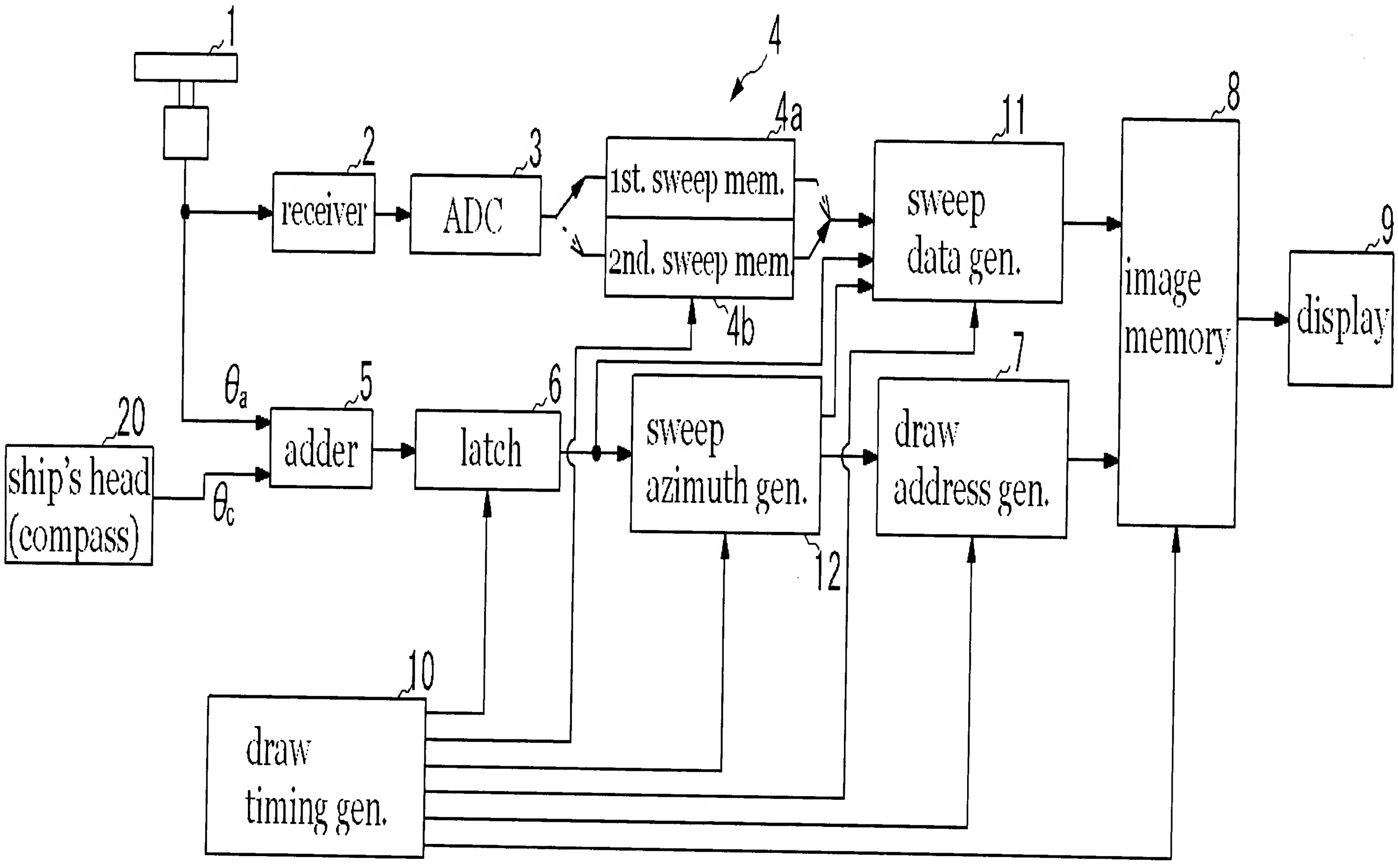

1
2
receiver
3
ADC
4
4a
1st. sweep mem.
2nd. sweep mem.
4b
11
sweep
data gen.
8
image
memory
9
display
7
θ_a
5
adder
6
latch
20
ship's head
(compass)
θ_c
sweep
azimuth gen.
12
draw
address gen.
10
draw
timing gen.

Fig.2

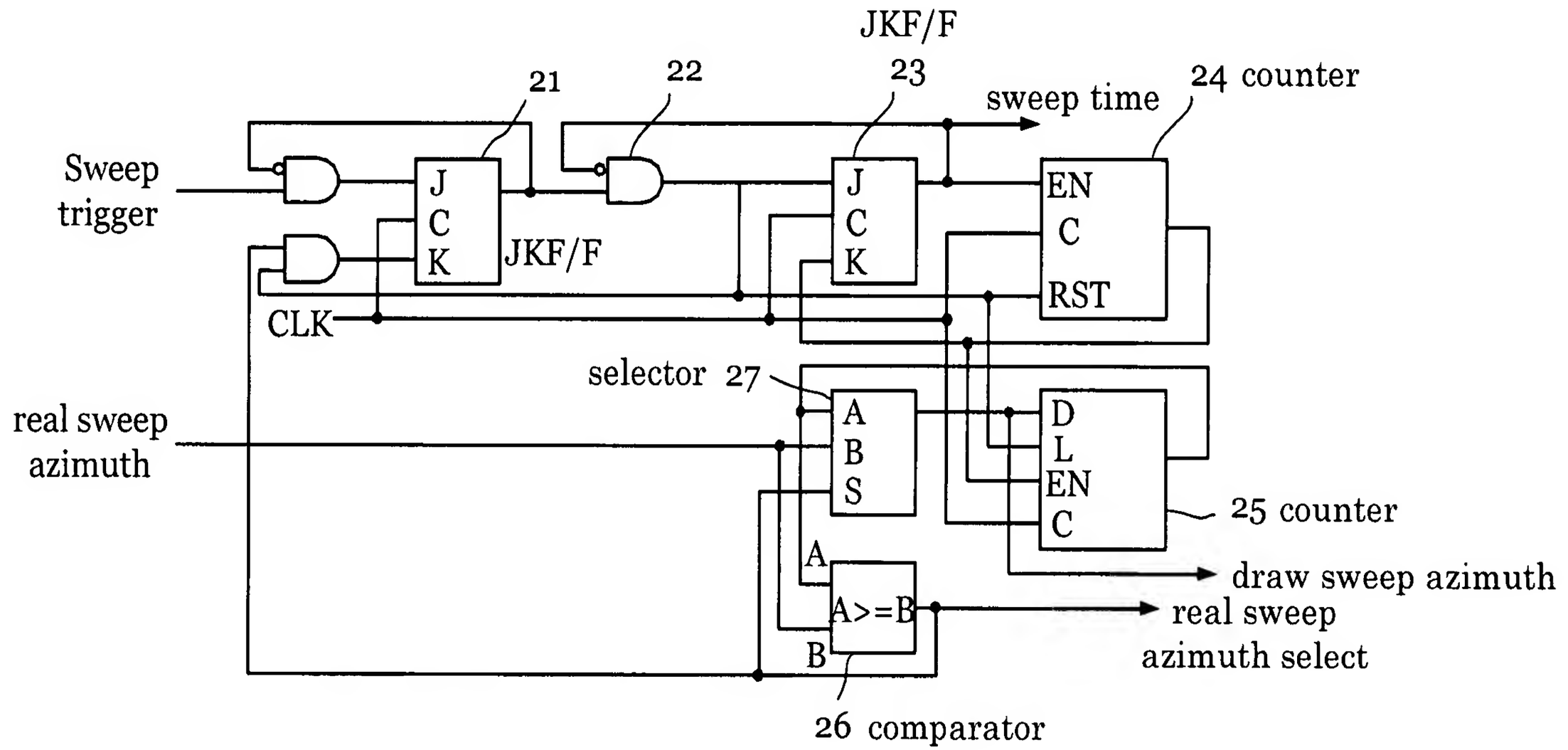

JKF/F
21
22
23
24 counter
sweep time
Sweep
trigger
J
C
K
JKF/F
J
C
K
EN
C
RST
CLK
selector 27
real sweep
azimuth
A
B
S
D
L
EN
C
25 counter
A
draw sweep azimuth
A>=B
real sweep
azimuth select
B
26 comparator

Fig.3

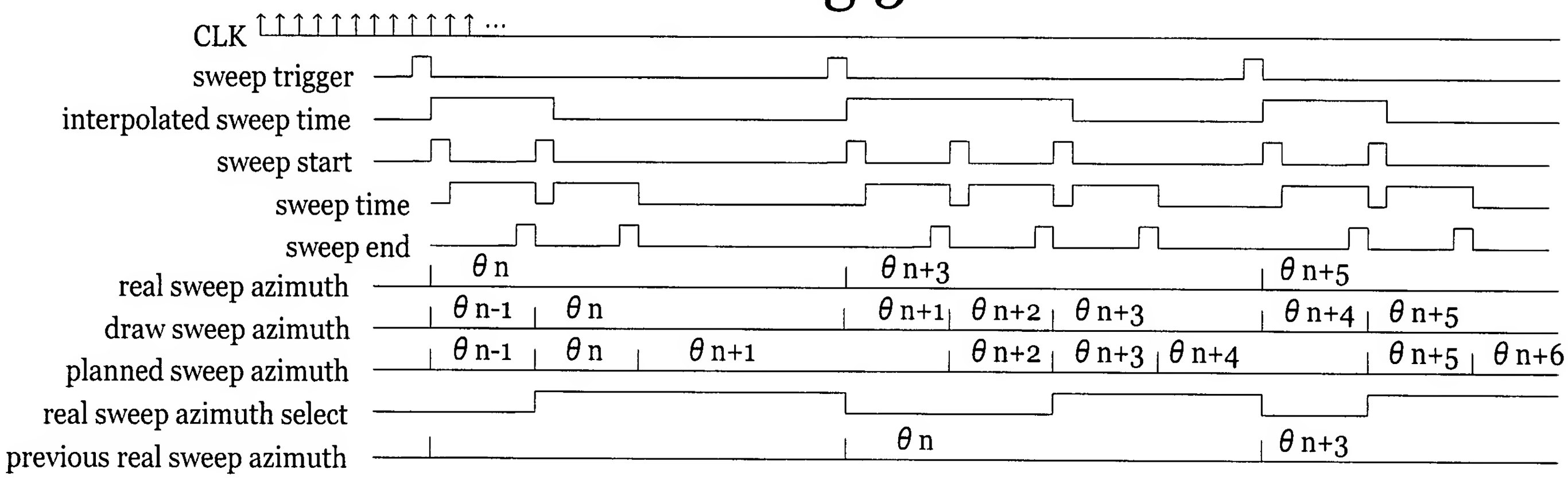

CLK
sweep trigger
interpolated sweep time
sweep start
sweep time
sweep end
real sweep azimuth
draw sweep azimuth
planned sweep azimuth
real sweep azimuth select
previous real sweep azimuth
θ n
θ n+3
θ n+5
θ n-1
θ n
θ n+1
θ n+2
θ n+3
θ n+4
θ n+5
θ n-1
θ n
θ n+1
θ n+2
θ n+3
θ n+4
θ n+5
θ n+6
θ n
θ n+3

Fig.4

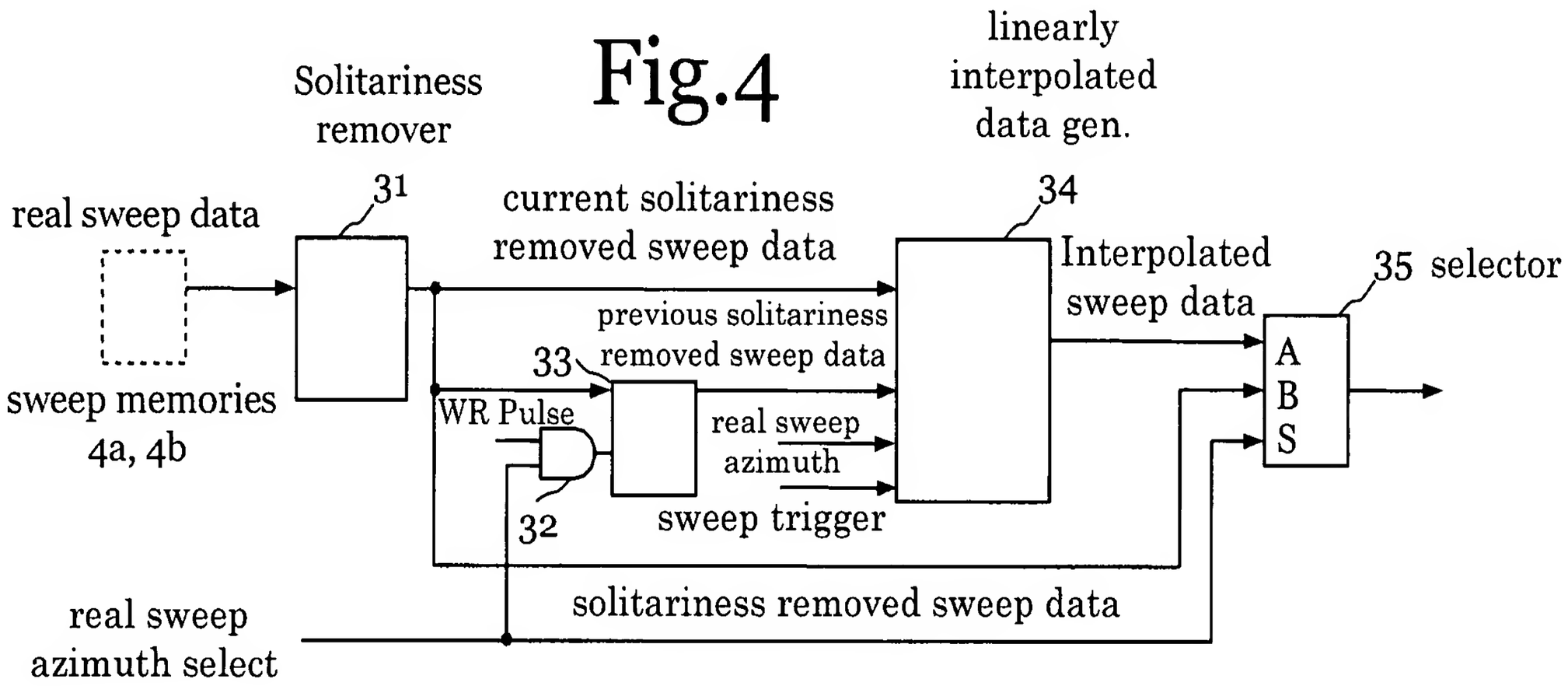

Solitariness remover
31
linearly interpolated data gen.
34
real sweep data
current solitariness removed sweep data
Interpolated sweep data
35 selector
previous solitariness removed sweep data
33
A
B
S
sweep memories 4a, 4b
WR Pulse
real sweep azimuth
32
sweep trigger
solitariness removed sweep data
real sweep azimuth select

Fig.5

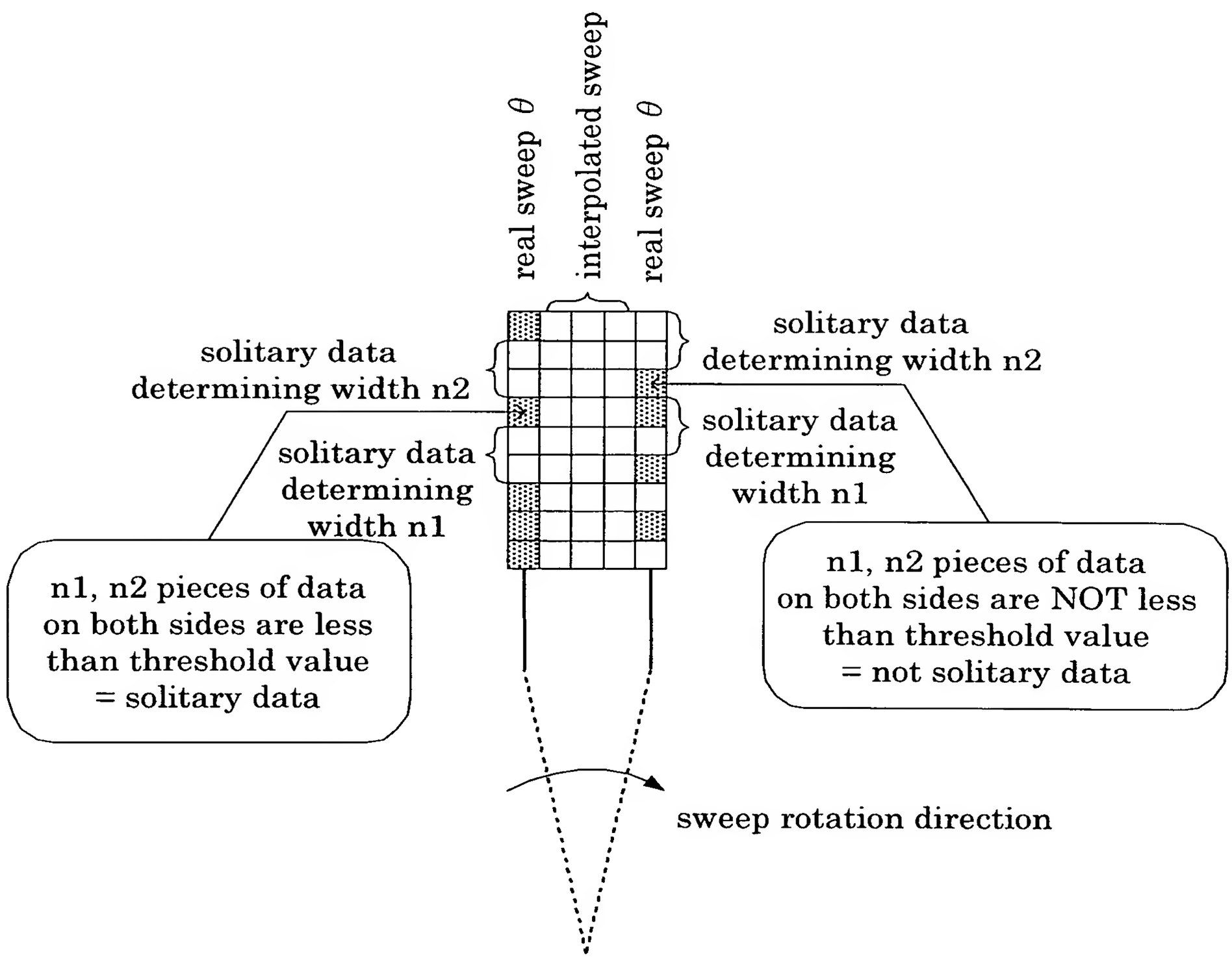

real sweep θ
interpolated sweep θ
real sweep θ
solitary data determining width n2
solitary data determining width n1
solitary data determining width n2
solitary data determining width n1
n1, n2 pieces of data on both sides are less than threshold value = solitary data
n1, n2 pieces of data on both sides are NOT less than threshold value = not solitary data
sweep rotation direction
:data having level no less than threshold value
:data having level less than threshold value

Fig.6

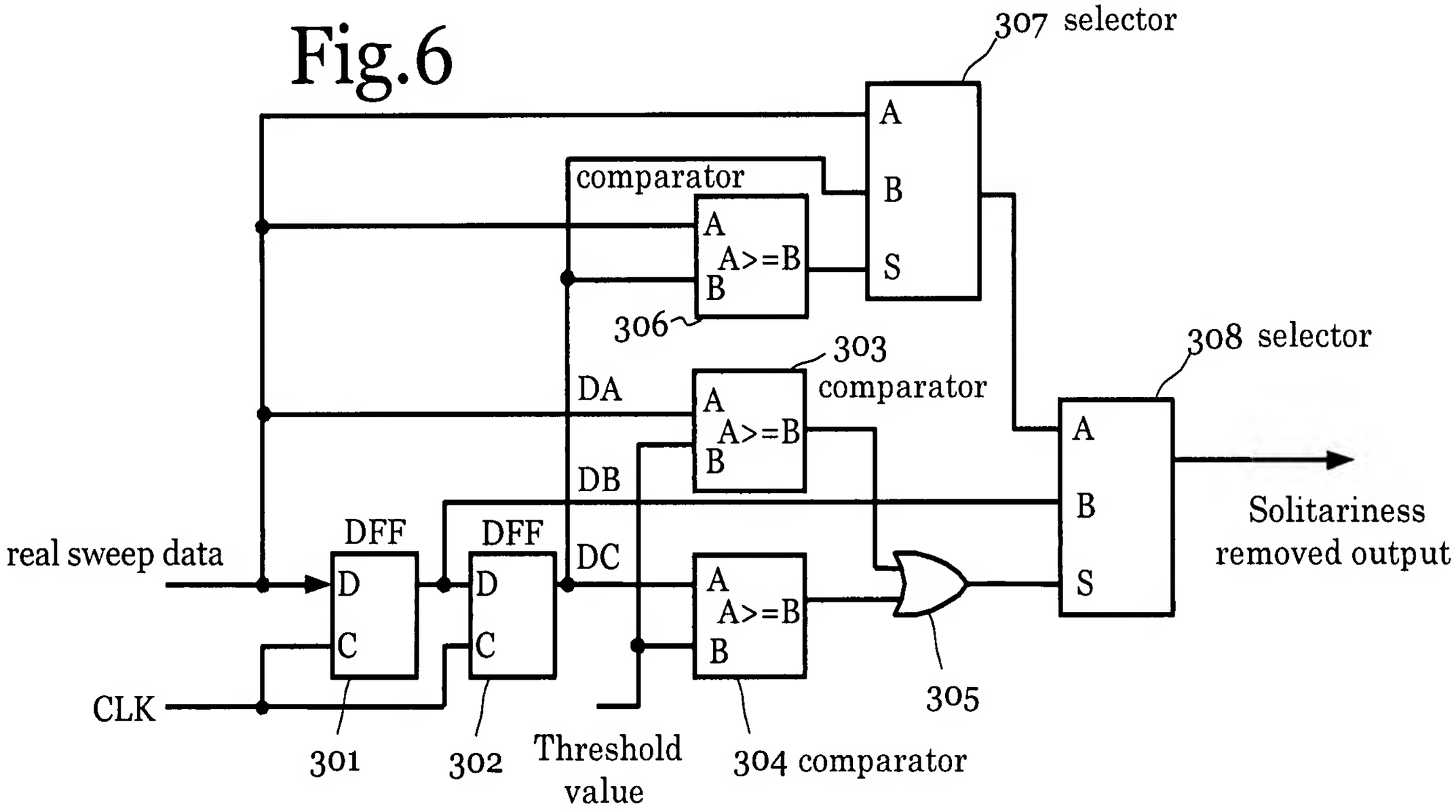

307 selector
A
B
S
comparator
A
A>=B
B
306
303
comparator
DA
A
A>=B
B
DB
308 selector
A
B
S
Solitariness
removed output
real sweep data
DFF
DFF
DC
D
C
D
C
A
A>=B
B
305
CLK
301
302
Threshold
value
304 comparator

Fig.7

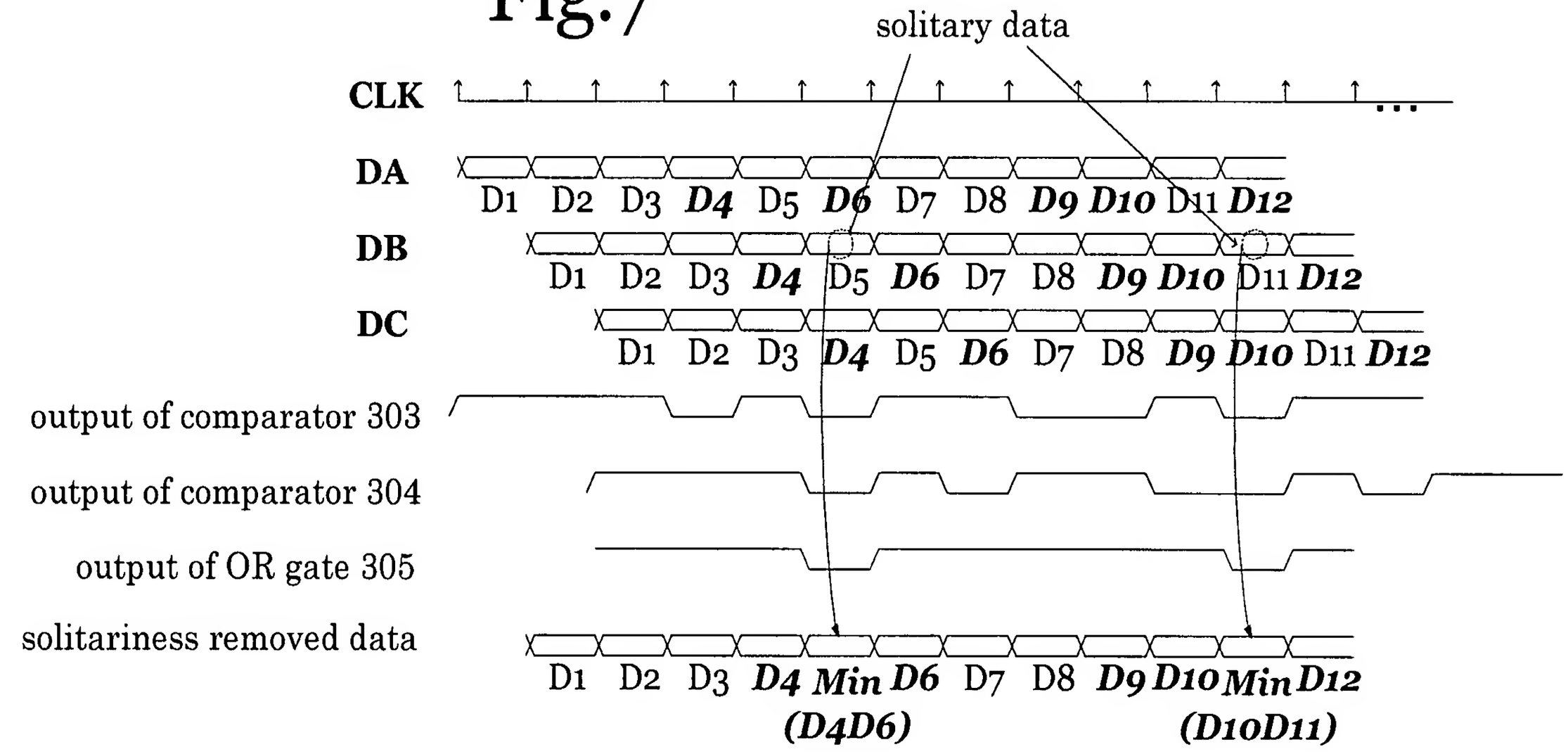

solitary data
CLK
DA
D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
DB
D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
DC
D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
output of comparator 303
output of comparator 304
output of OR gate 305
solitariness removed data
D1 D2 D3 D4 Min D6 D7 D8 D9 D10 Min D12
(D4D6)
(D10D11)

Fig.8

Fig.8 (a)

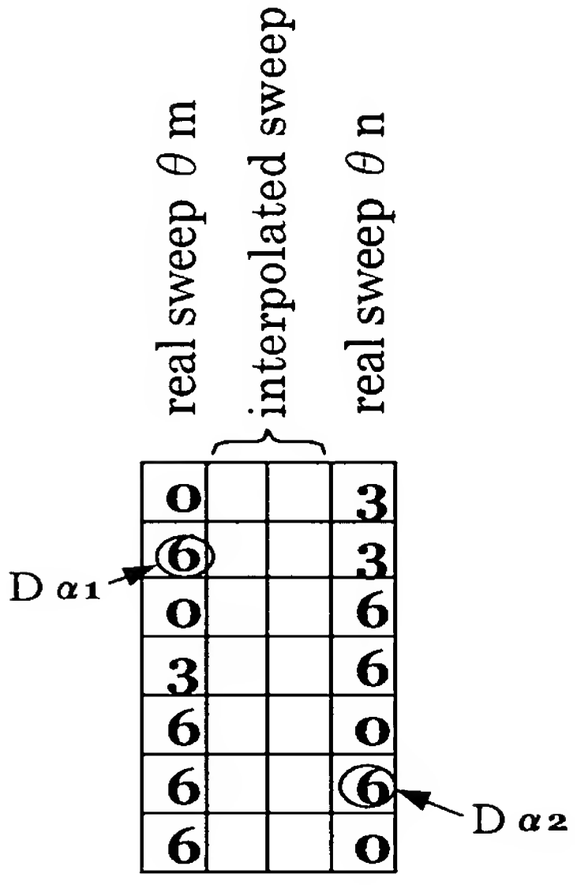


Fig.8 (b)

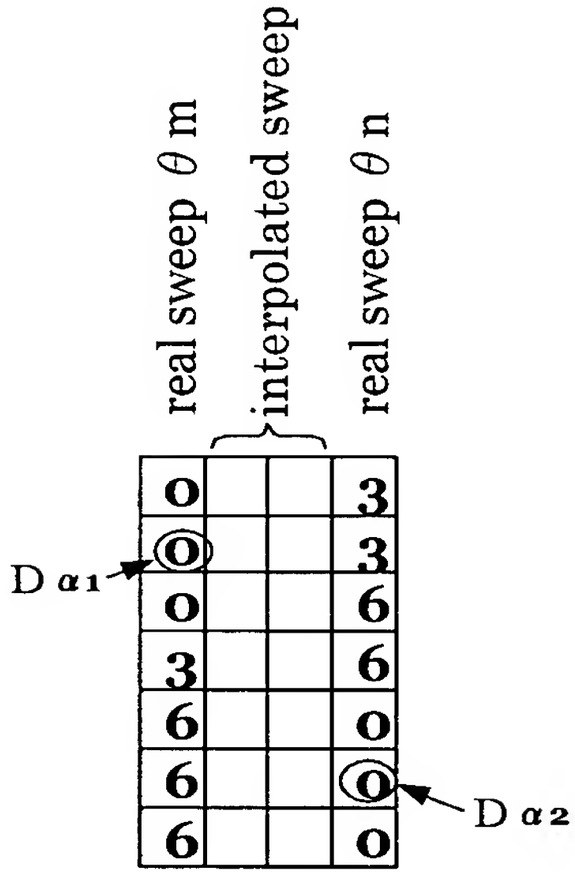


Fig.8 (c)

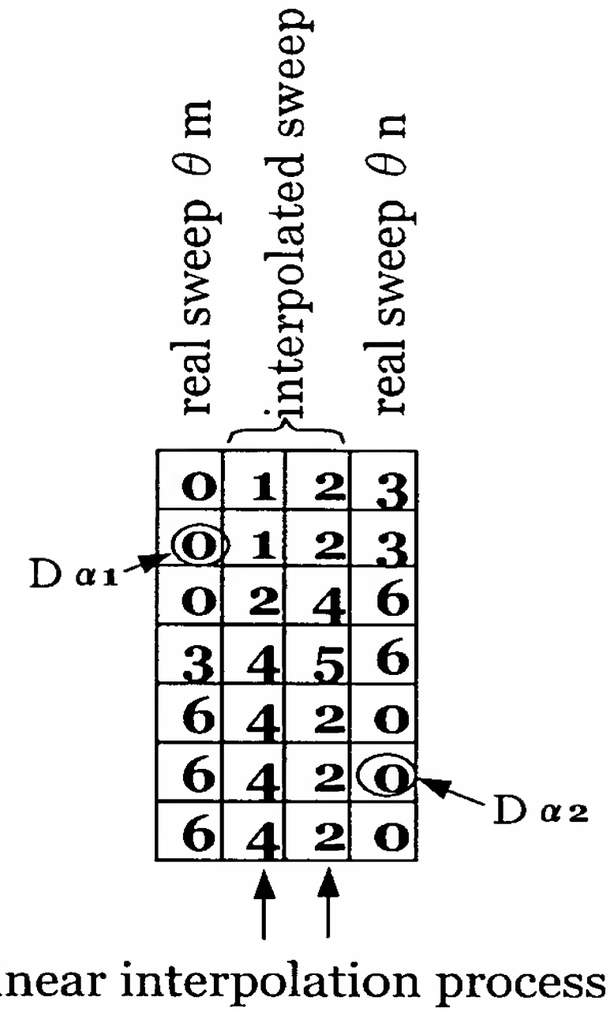


Fig.9

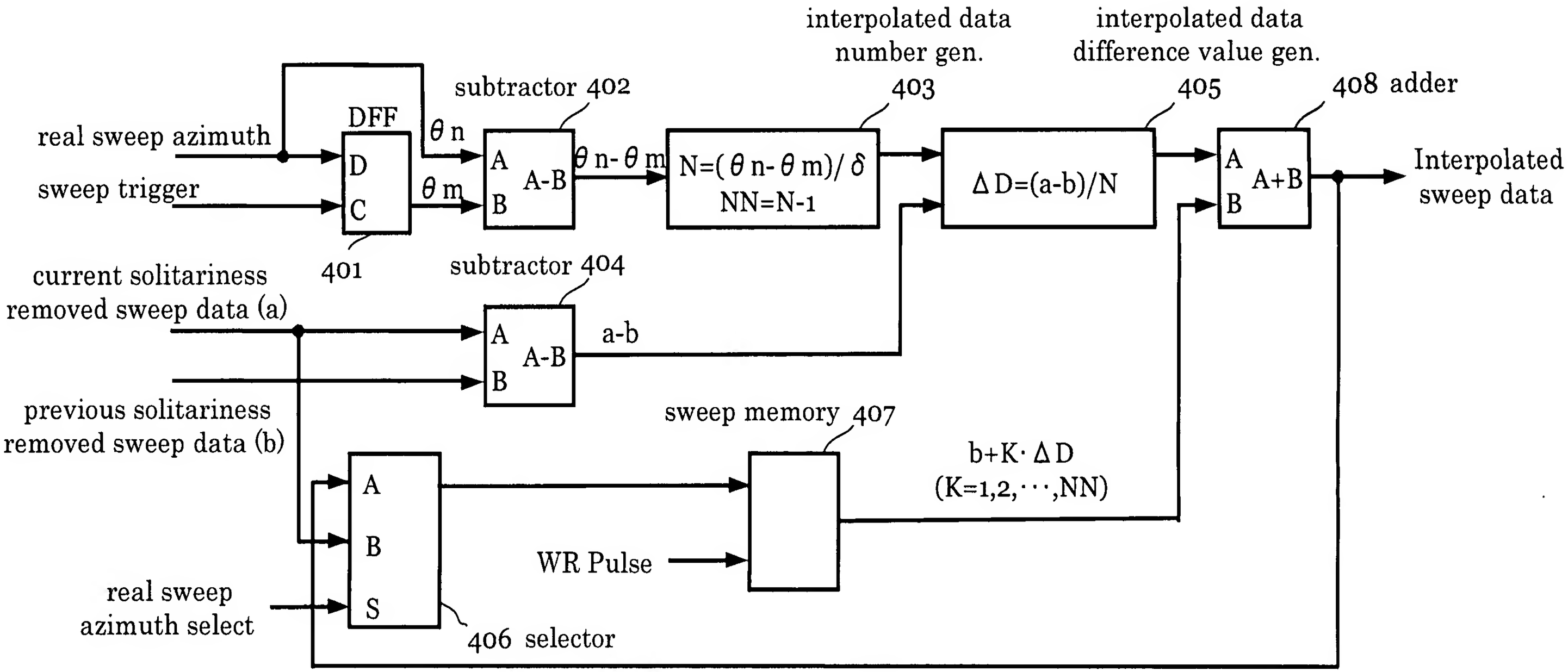

real sweep azimuth
sweep trigger
DFF
D
C
401
θ n
θ m
subtractor 402
A
B
A-B
θ n- θ m
interpolated data number gen.
403
N=(θ n- θ m)/ δ
NN=N-1
interpolated data difference value gen.
405
Δ D=(a-b)/N
408 adder
A
B
A+B
Interpolated sweep data
current solitariness removed sweep data (a)
previous solitariness removed sweep data (b)
subtractor 404
A
B
A-B
a-b
sweep memory 407
b+K· Δ D
(K=1,2,···,NN)
WR Pulse
real sweep azimuth select
A
B
S
406 selector

Fig.10

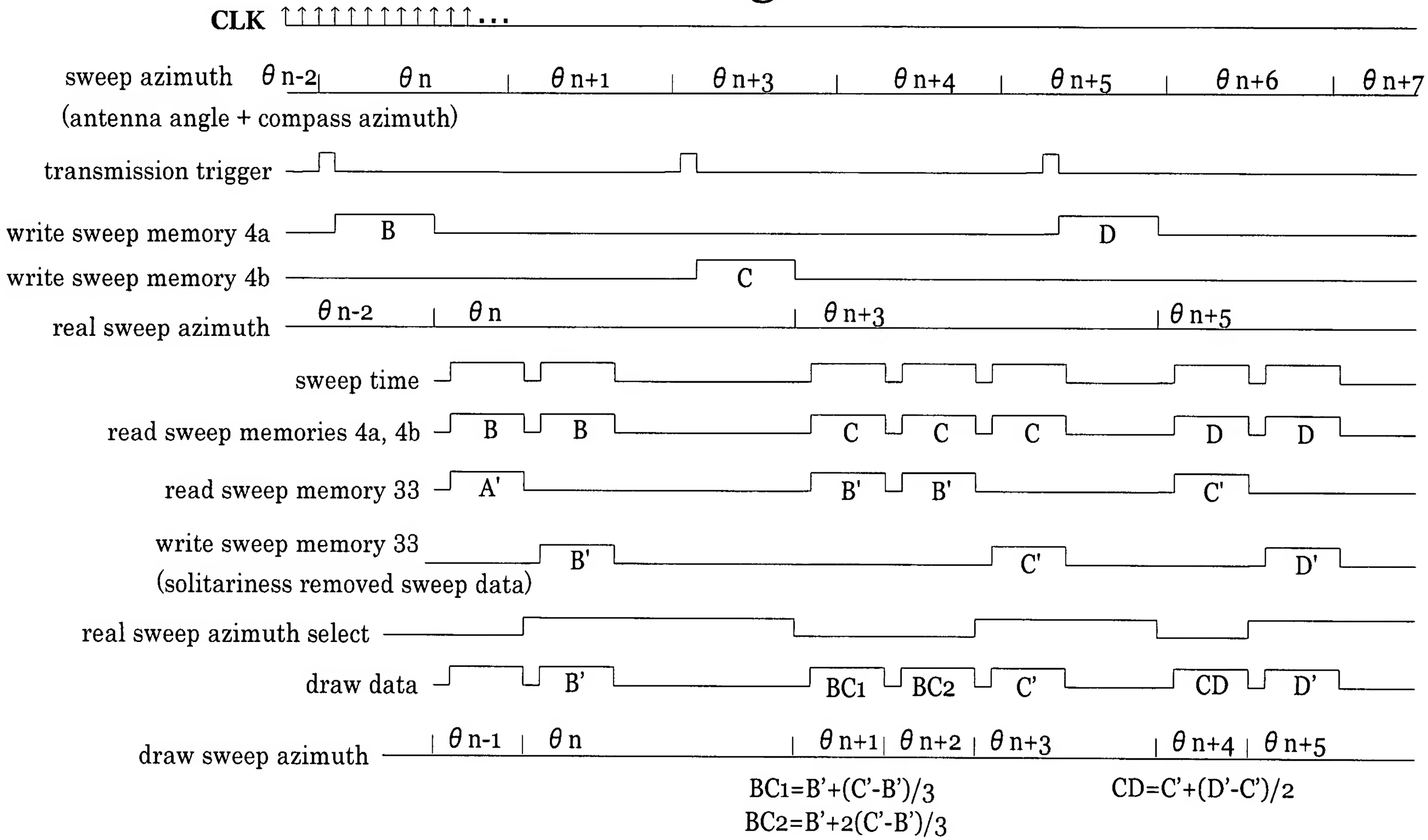
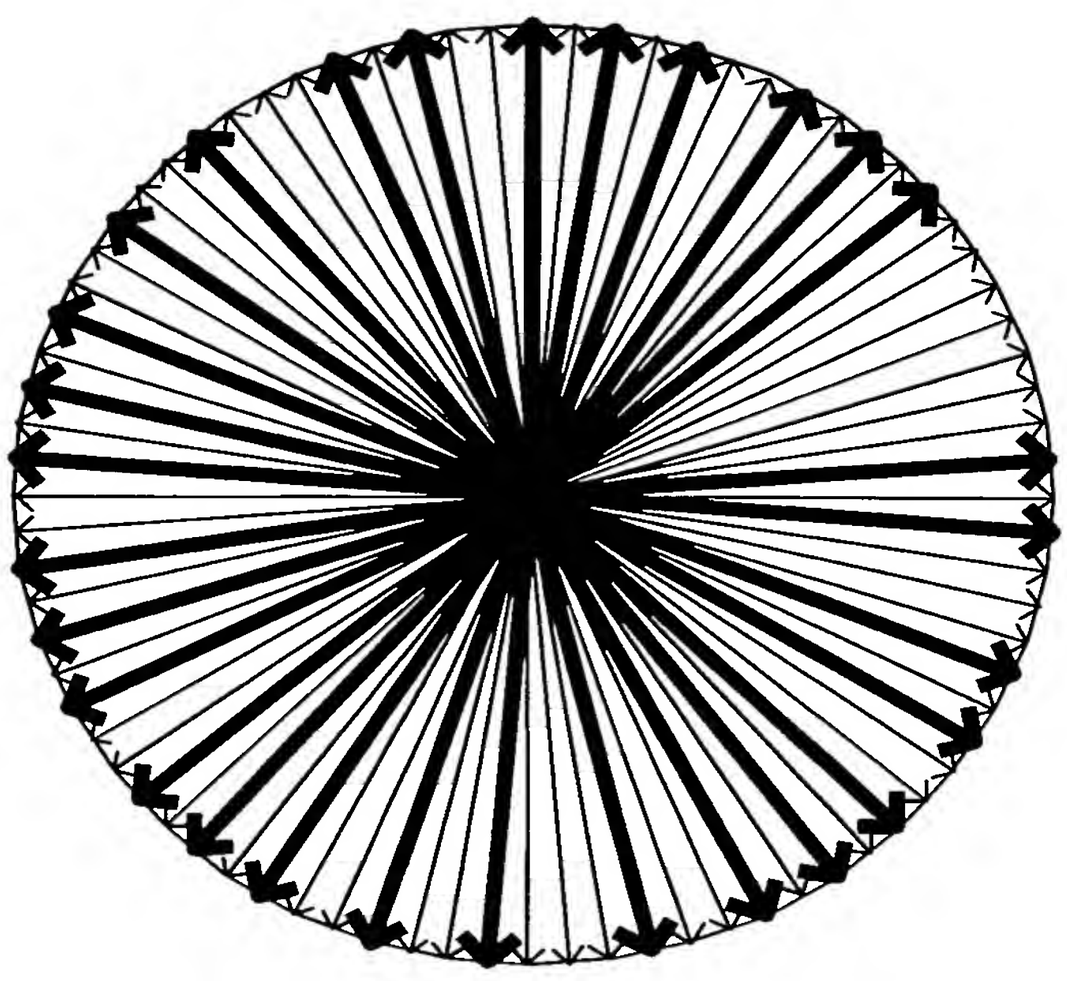

CLK
sweep azimuth
θ n-2
θ n
θ n+1
θ n+3
θ n+4
θ n+5
θ n+6
θ n+7
(antenna angle + compass azimuth)
transmission trigger
write sweep memory 4a
B
D
write sweep memory 4b
C
real sweep azimuth
θ n-2
θ n
θ n+3
θ n+5
sweep time
read sweep memories 4a, 4b
B
B
C
C
C
D
D
read sweep memory 33
A'
B'
B'
C'
write sweep memory 33
(solitariness removed sweep data)
B'
C'
D'
real sweep azimuth select
draw data
B'
BC1
BC2
C'
CD
D'
draw sweep azimuth
θ n-1
θ n
θ n+1
θ n+2
θ n+3
θ n+4
θ n+5
BC1=B'+(C'-B')/3
BC2=B'+2(C'-B')/3
CD=C'+(D'-C')/2

Fig.11



thick-line arrow: real sweep

thin-line arrow: interpolated sweep

Fig.12

Fig.12 (a)

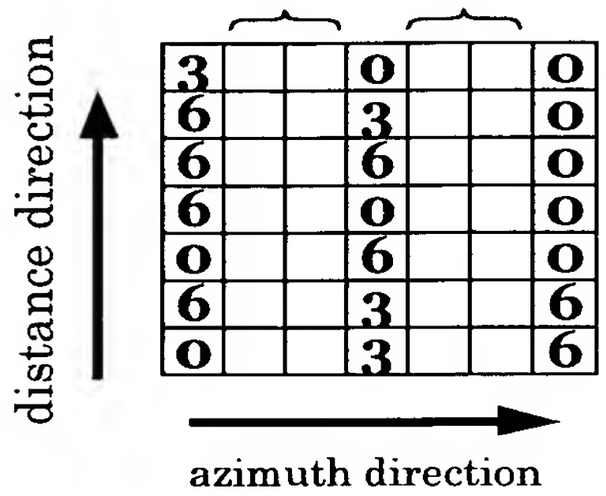


Fig.12 (b)

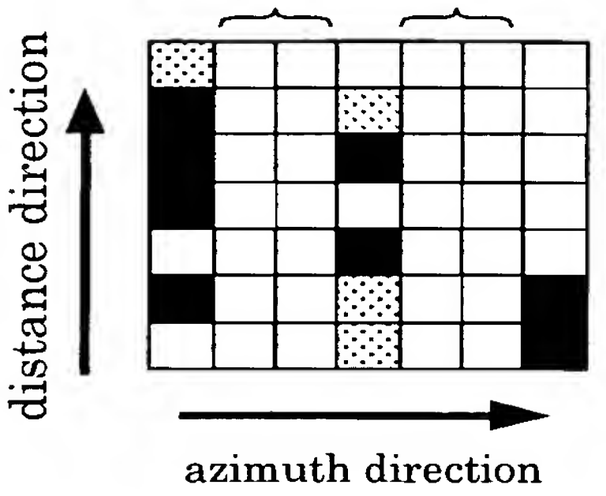


Fig.12 (c)

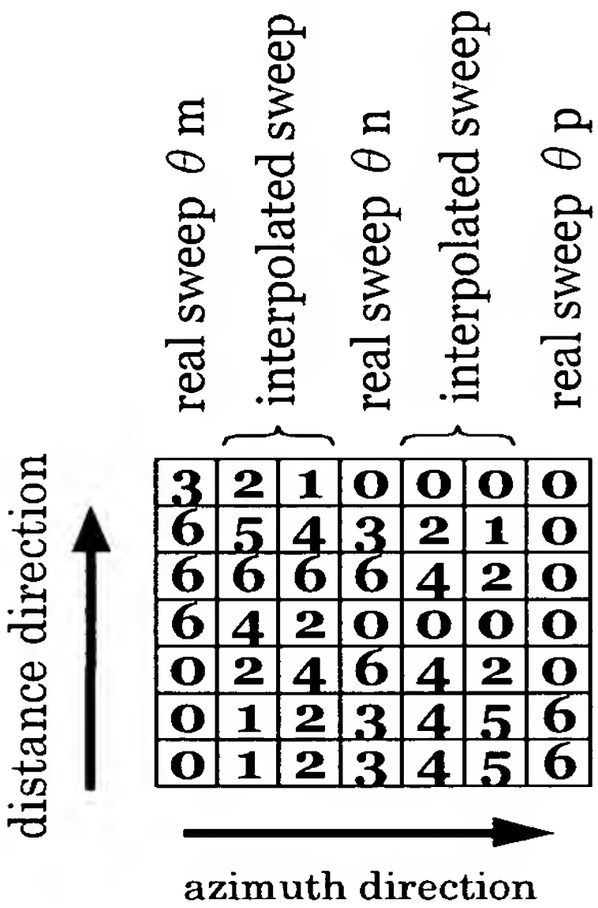


Fig.12 (d)

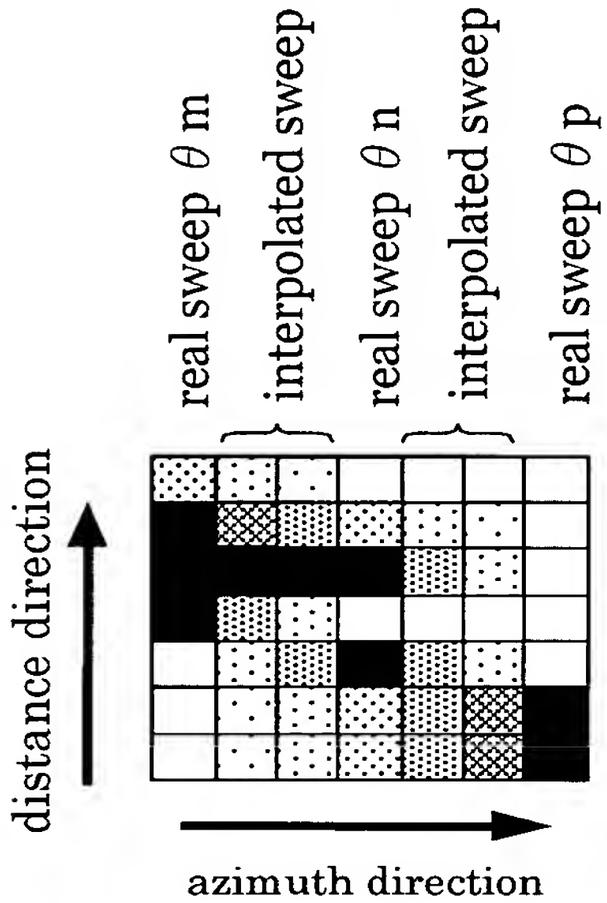


Fig.12 (e)

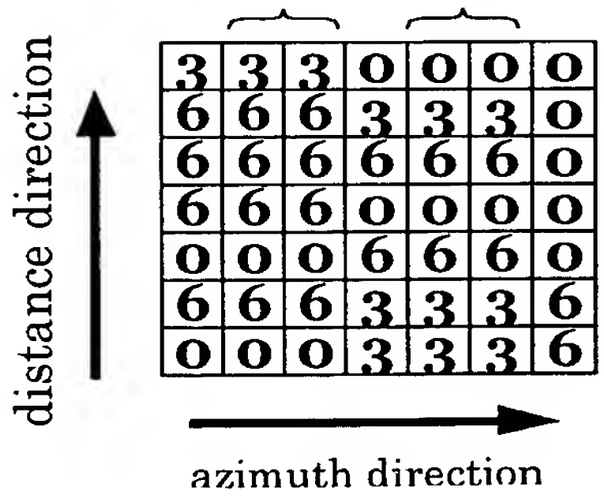
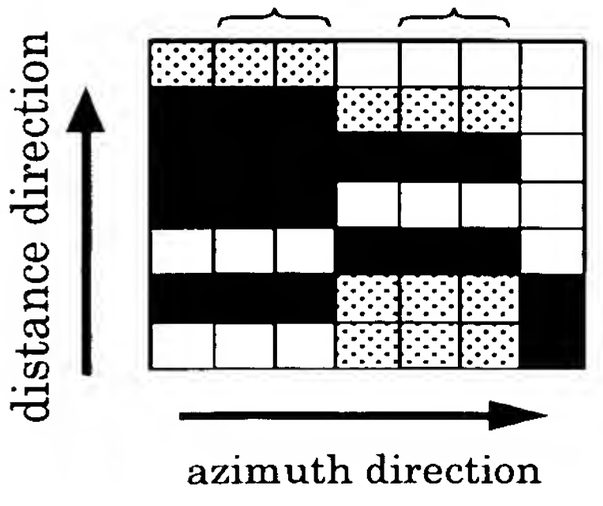


Fig.12 (f)



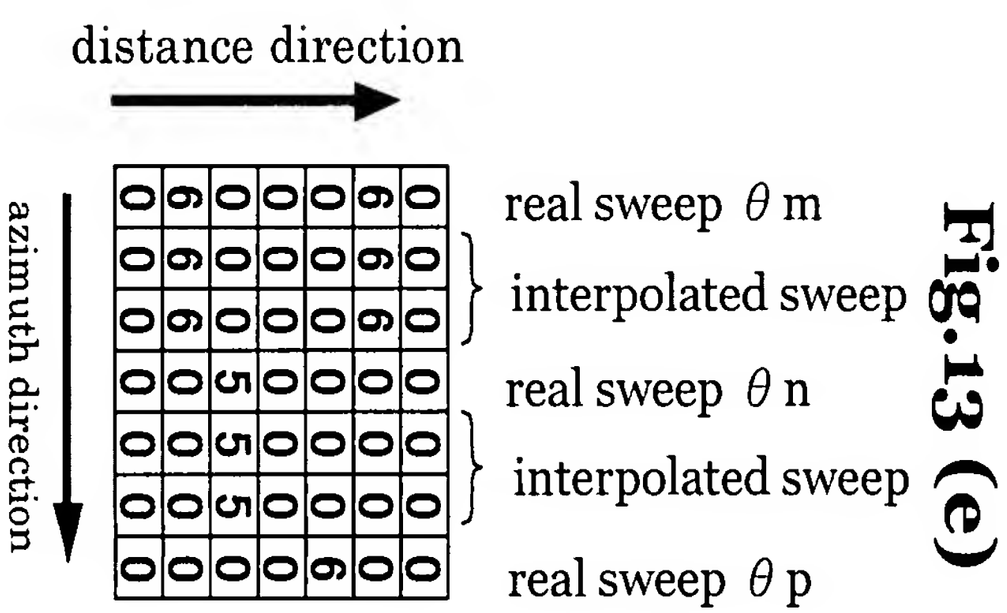


Fig.13 (e)

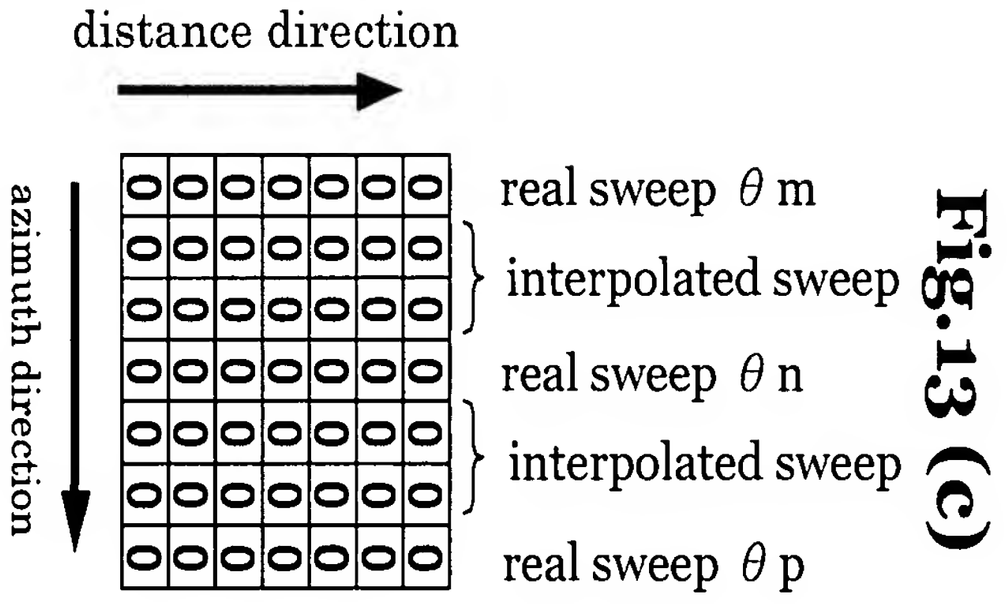


Fig.13 (c)

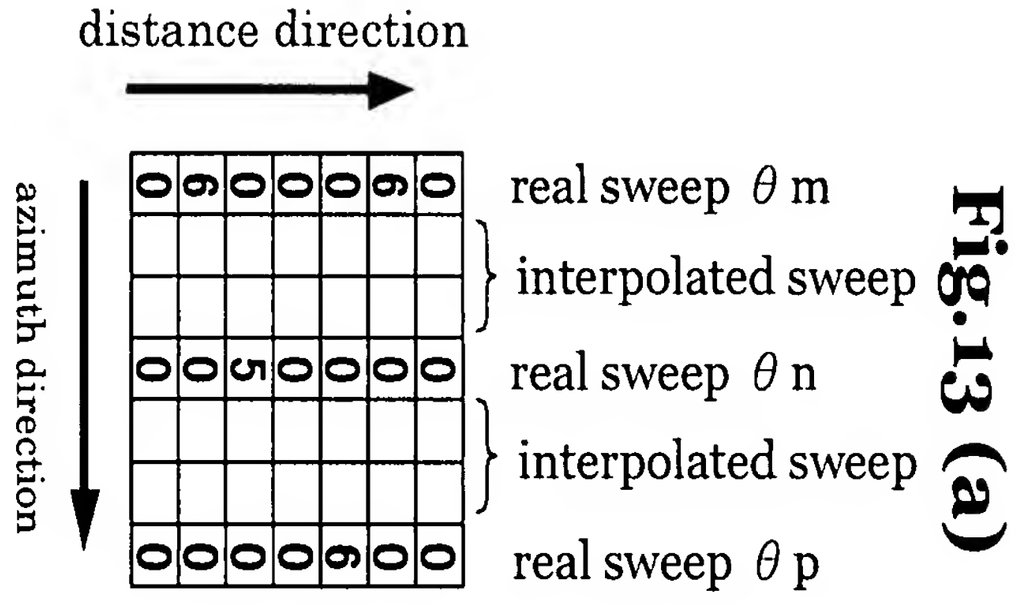


Fig.13 (a)

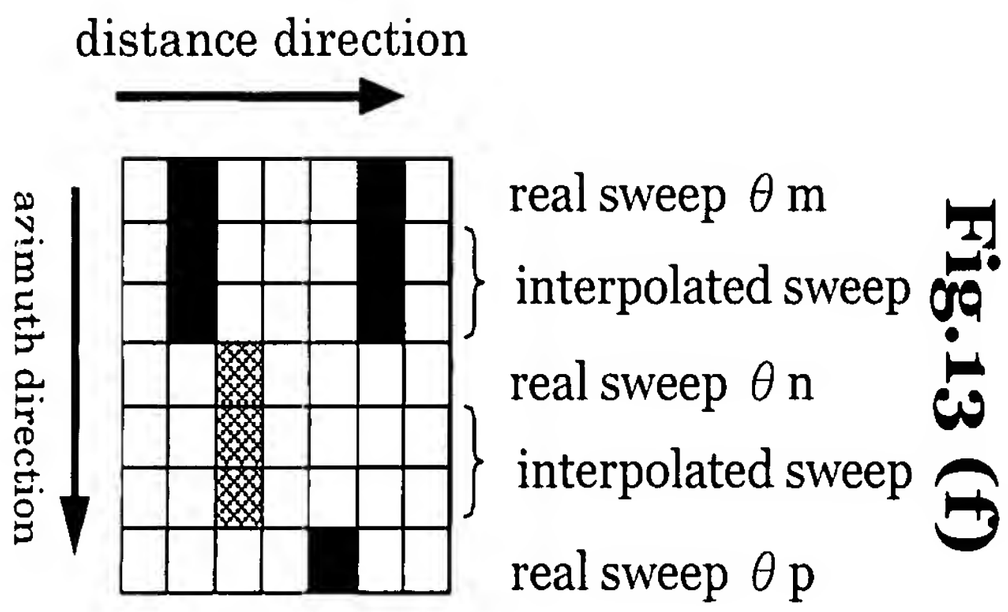


Fig.13 (f)

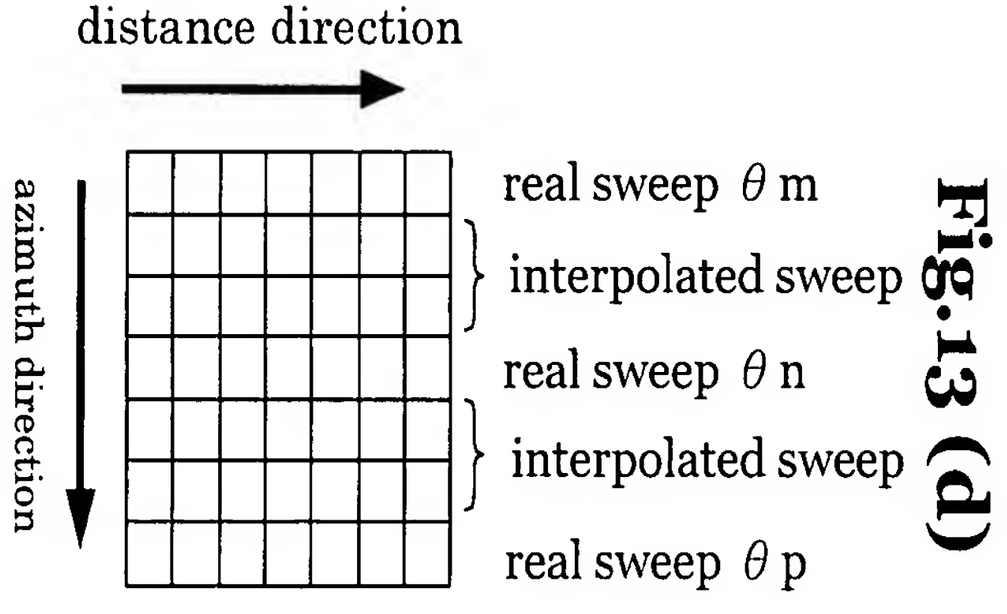


Fig.13 (d)

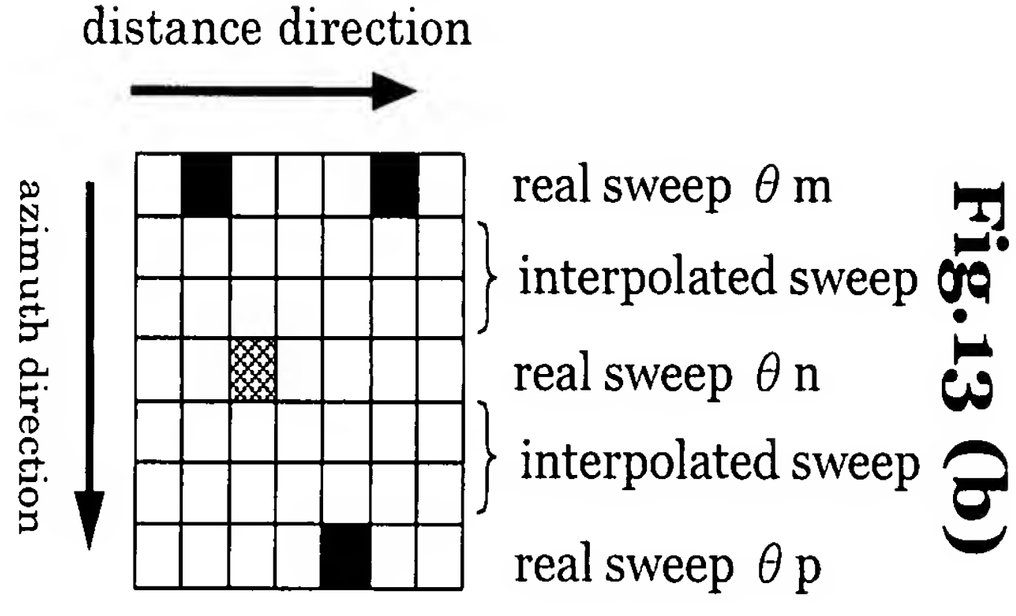


Fig.13 (b)

Fig.14

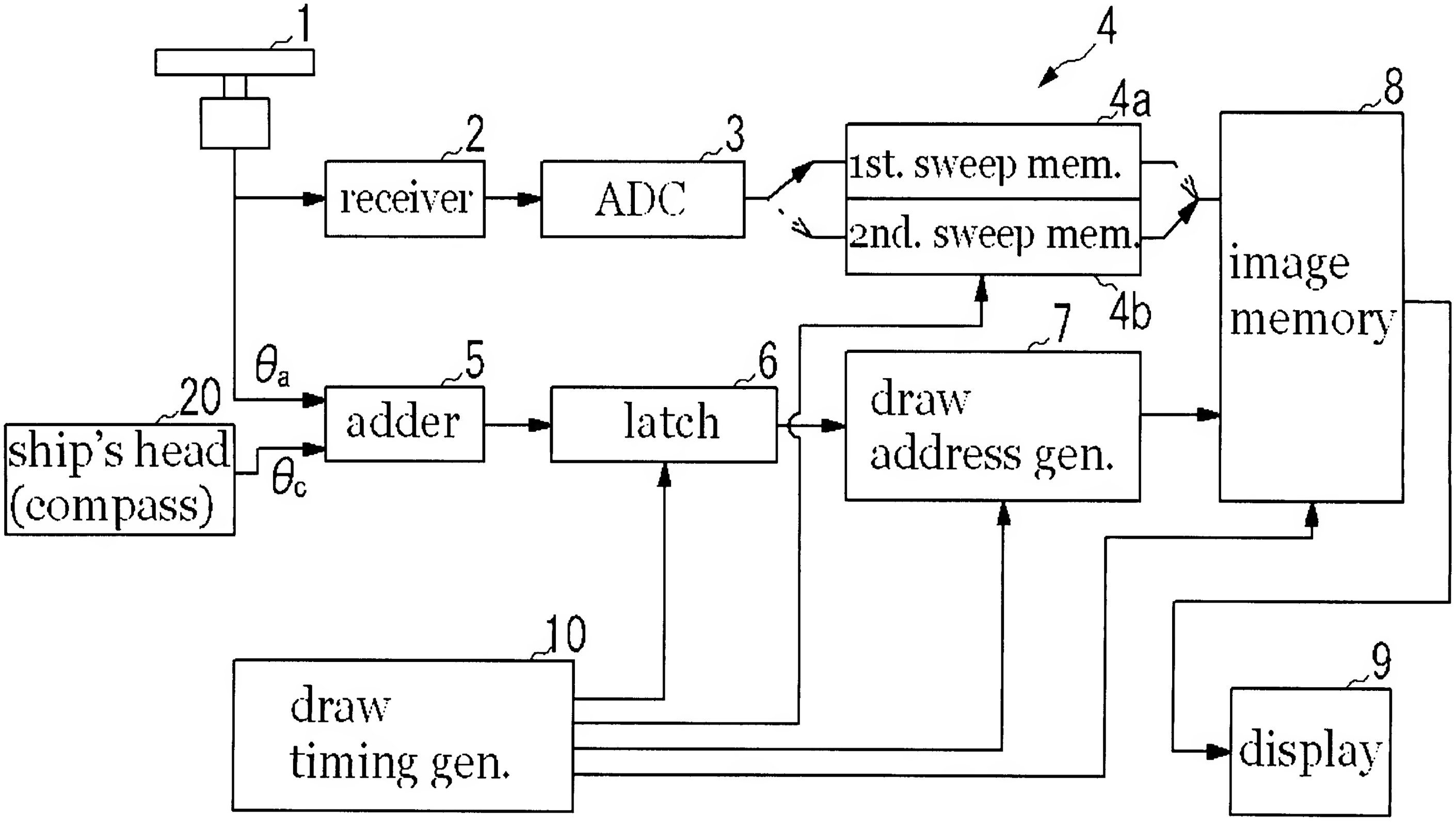

1
2
receiver
3
ADC
4
4a
1st. sweep mem.
2nd. sweep mem.
4b
8
image memory
7
draw address gen.
θ_a
5
adder
6
latch
20
ship's head (compass)
θ_c
10
draw timing gen.
9
display

Fig.15

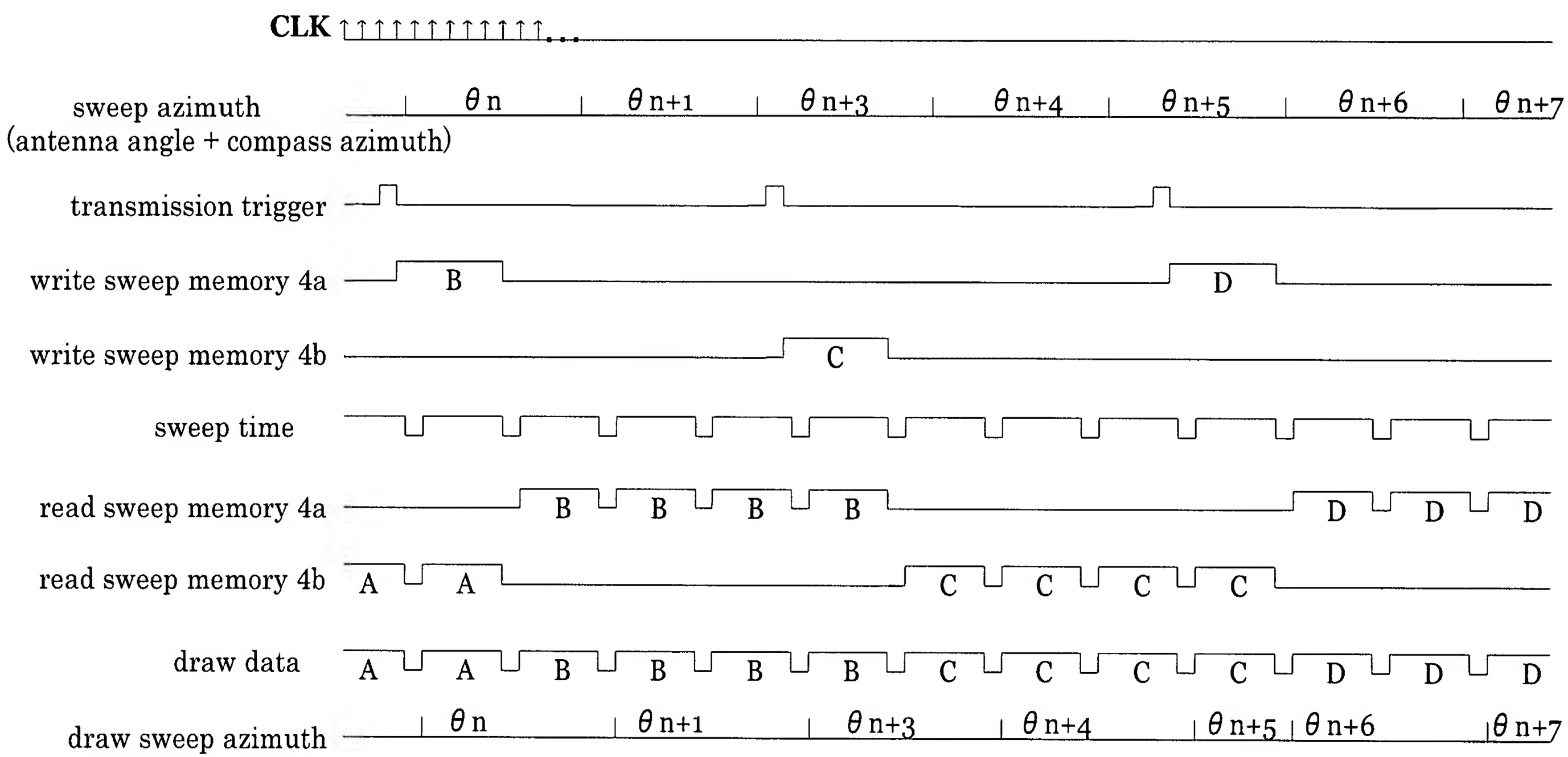
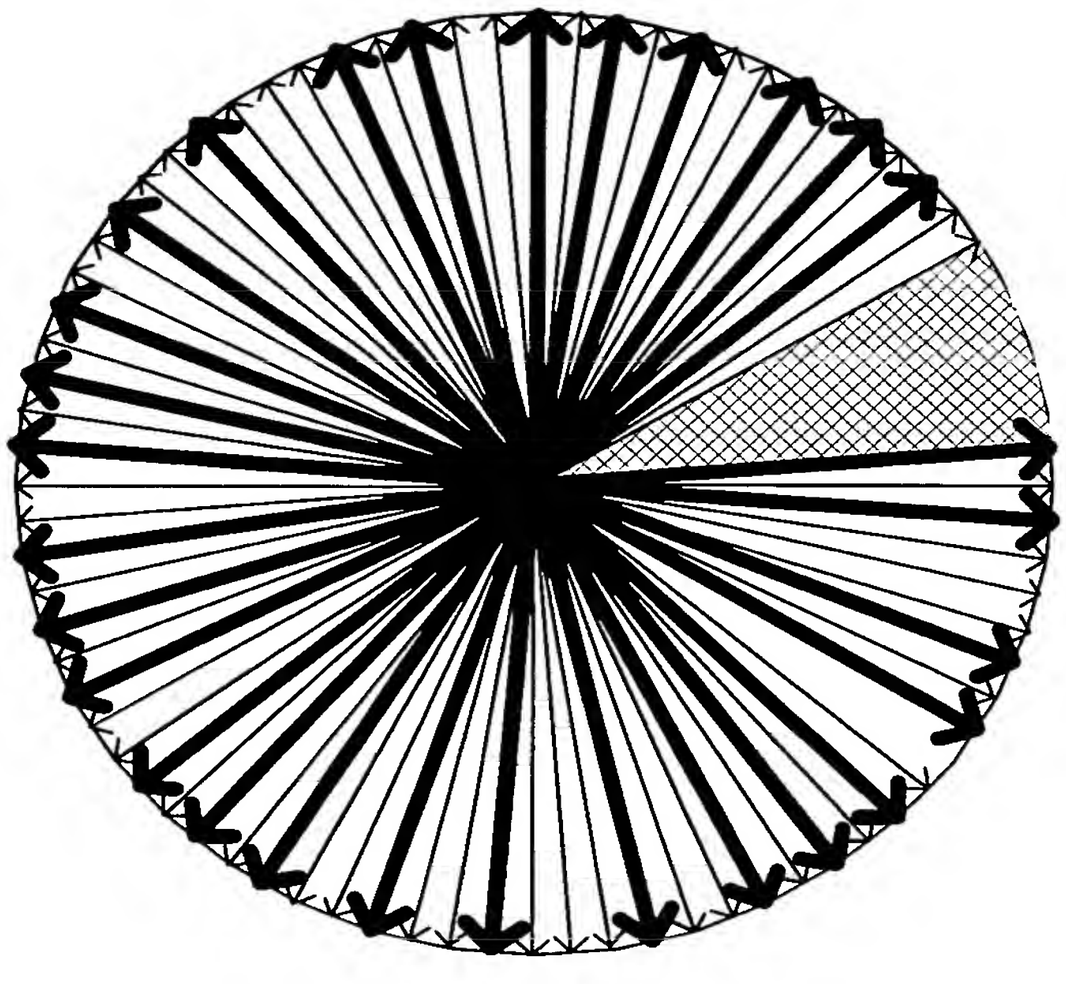

CLK
sweep azimuth
(antenna angle + compass azimuth)
θ n
θ n+1
θ n+3
θ n+4
θ n+5
θ n+6
θ n+7
transmission trigger
write sweep memory 4a
B
D
write sweep memory 4b
C
sweep time
read sweep memory 4a
B B B B
D D D
read sweep memory 4b
A A
C C C C
draw data
A A B B B B C C C C D D D
draw sweep azimuth
θ n
θ n+1
θ n+3
θ n+4
θ n+5
θ n+6
θ n+7

Fig.16



thick-line arrow: real sweep

thin-line arrow: interpolated sweep

hatched portion: non-updated data portion

Fig.17

Fig.17 (a)

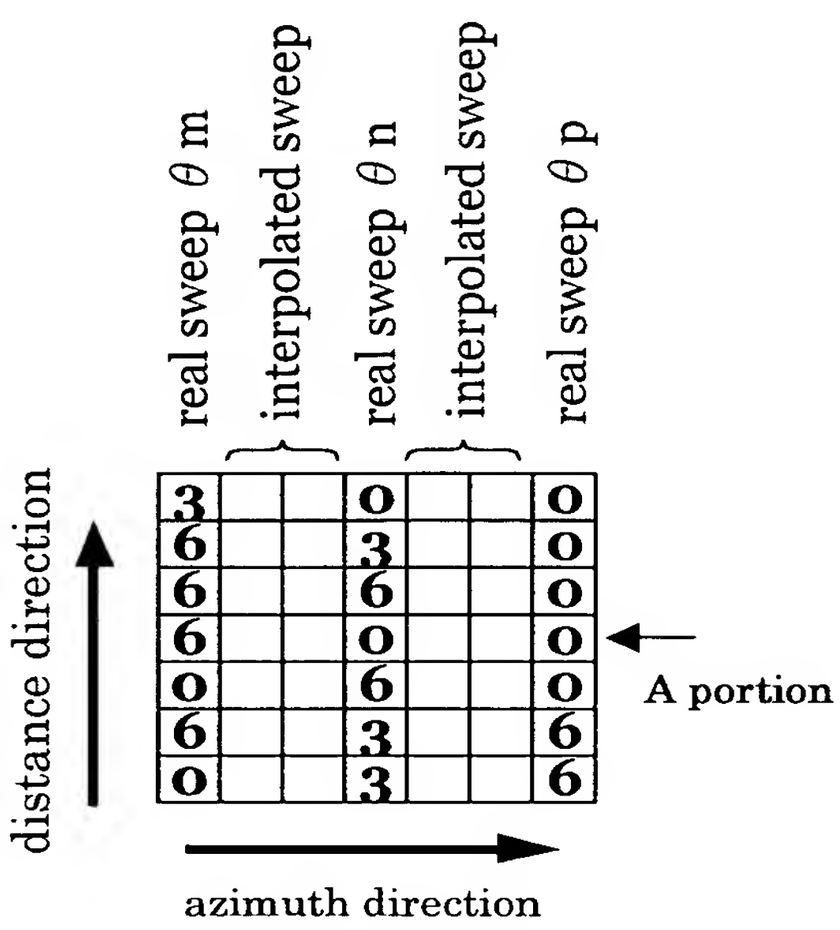


Fig.17 (b)

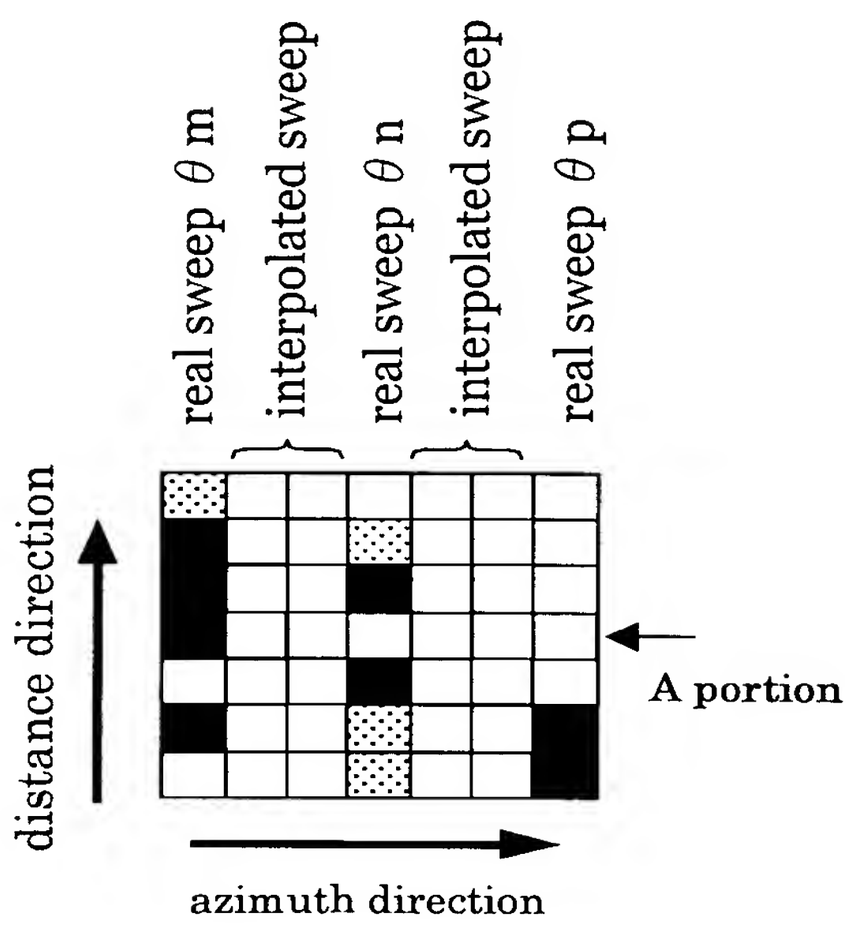


Fig.17 (c)

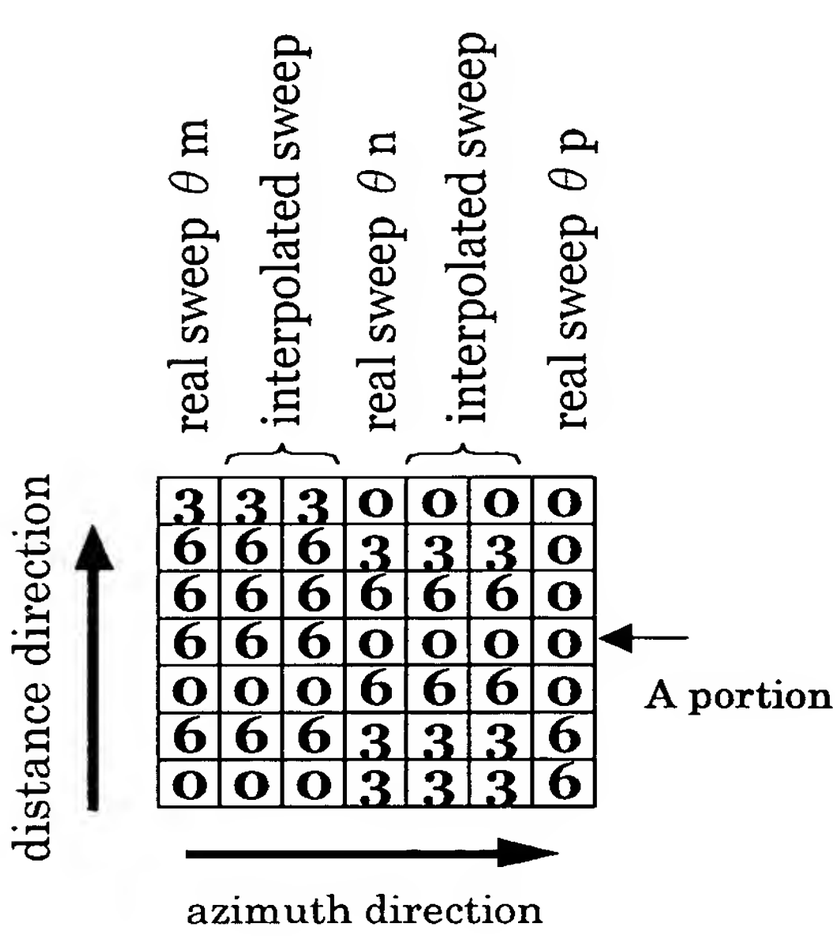


Fig.17 (d)

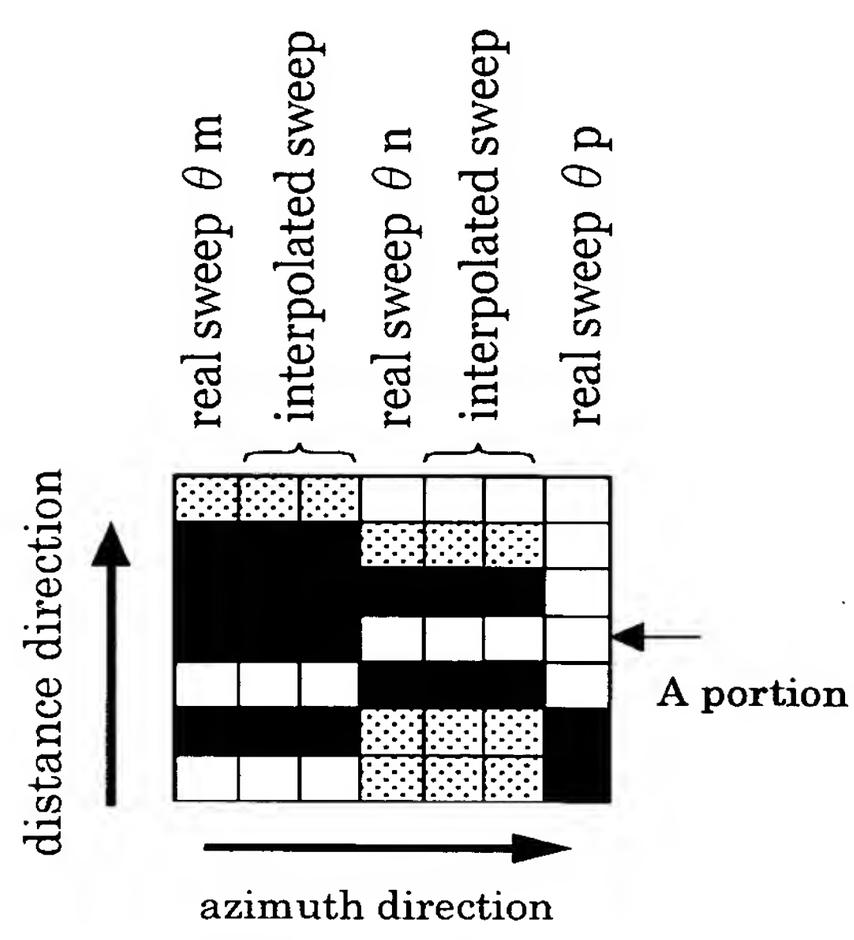


Fig.18

Fig.18 (a)

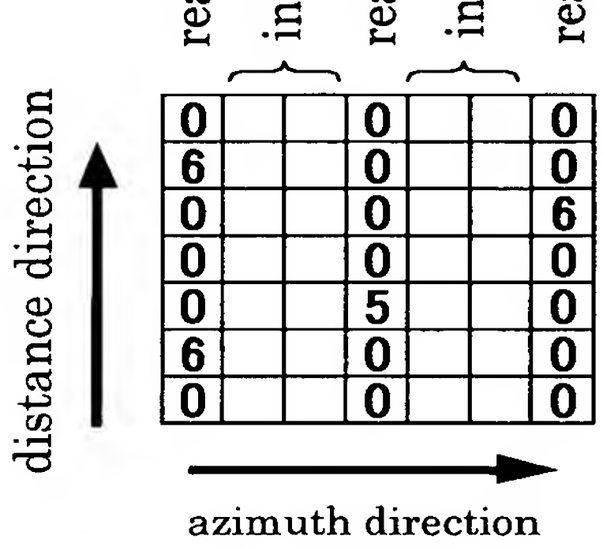


Fig.18 (b)

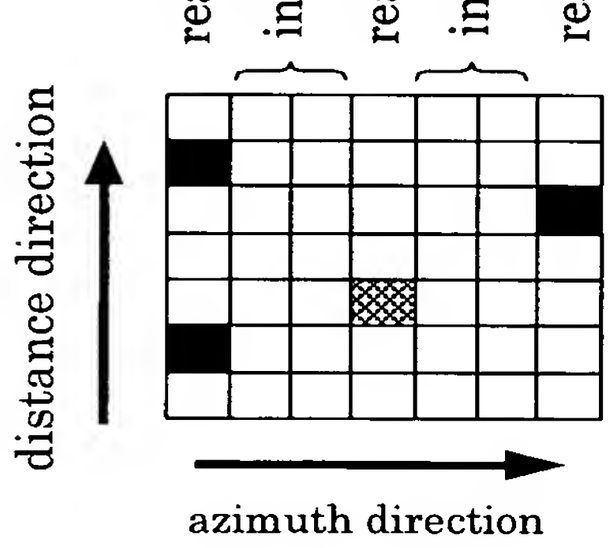


Fig.18 (c)

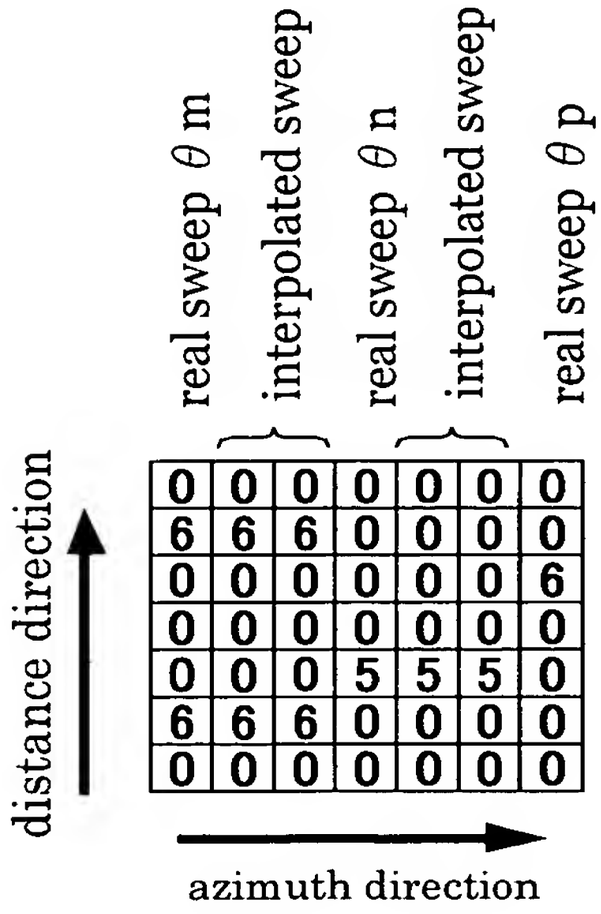
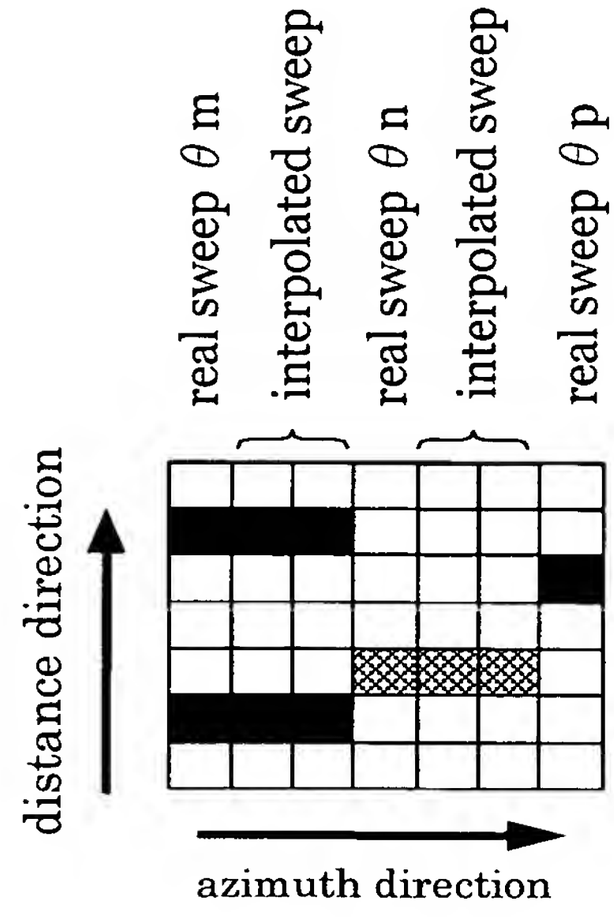



Fig.18 (d)